CUE 02 0012

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Application for Critical Use Exemption of Methyl Bromide for Use in 2005 in the United States

WHY IS THIS INFORMATION NEEDED?	Under the Clean Air Act and the international treaty to protect the ozone layer (the Montreal Protocol on Substances that Deplete the Ozone Layer), the production and import of methyl bromide will be phased out in the United States on January 1, 2005. This application seeks information to support a U.S. request to produce and import methyl bromide for certain critical uses and circumstances beyond this 2005 phaseout date. The information in this application will be used to review whether your use of methyl bromide is "critical" because no technically and economically feasible alternatives are available. In order to estimate the loss as a result of not having methyl bromide available, EPA needs to compare data (yields, crop/commodity prices, revenues and costs) for your use of methyl bromide with uses of alternative pest control regimens. If you submit a well documented application with sound reasons why alternatives are not technically and economically feasible, the U.S. government can be a better advocate for your exemption request internationally.

Click on the Instructions tab located at the bottom of the screen for additional information.

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INSTRUCTIONS

The information provided by you in this application will be used to evaluate the requested methyl bromide use. The U.S. and other countries that are parties to the Montreal Protocol On Substances That Deplete The Ozone Layer decided that: "a use of methyl bromide should qualify as "critical" only if the nominating Party determines that:

(i) The specific use is critical because the lack of availability of methyl bromide for that use would result in a significant market disruption; and
(ii) There are no technically and economically feasible alternatives available to the user that are acceptable from the standpoint of environment and health and are suitable to the crops and circumstances of the nomination ..."

WHO APPLIES?	If you anticipate that you will need methyl bromide in 2005 because you believe there are no technically and economically feasible alternatives, then you should apply for the critical use exemption. This application may be submitted either by a consortium representing multiple users or by individual users. We encourage users with similar circumstances of use to submit a single application (for example, any number of pre-plant users with similar soil, pest, and climactic conditions can submit a single application.) If a consortium is applying for multiple methyl bromide users, the economic data should be for a representative or typical user within the consortium unless otherwise noted. If economic or technical factors (such as size of the farm) affecting the ability of this "representative user" to use alternatives are significantly different than other users in the consortium, more than one application should be submitted to reflect these differences. Please contact your local, state, regional or national commodity association and/or state representative agency to find out if they plan on submitting an application on behalf of your commodity group.
STATE CONTACTS	States that have agreed to participate in the exemption process are listed on EPA's website at www.epa.gov/ozone/mbr/cue
HOW DO I APPLY?	You may either complete an electronic (Microsoft Excel) or a printed version of the application. Please fill out each form or worksheet in the application as completely as possible. If you are completing the printed version and need extra space you may attach additional sheets as needed. Additional information may be available from your local state department of agriculture or at the sites listed below or by calling 1-800-296-1996.
SECTIONS OF WORKBOOK	Each worksheet number corresponds to the tab number in the electronic version of the application. Instructions specific to each worksheet are provided at the top of each sheet. A header row is included on each worksheet to include an application ID number that EPA will assign. **Instructions** **Worksheet 1.** Contact and Methyl Bromide Request Information **Worksheet 2.** Methyl Bromide - Historical Data 2-A. Methyl Bromide Use 1997-2000 2-B. Methyl Bromide - Crop/Commodity Yield and Revenue 1997-2000 2-C. Methyl Bromide - Crop/Commodity Yield and Revenue 2001 2-D. Methyl Bromide Use and Costs for 2001 2-E. Methyl Bromide - Other Operating Costs for 2001 2-F. Methyl Bromide - Fixed and Overhead Costs **Worksheet 3.** Alternatives - Feasibility of Alternatives to Methyl Bromide 3-A. Alternatives - Technical Feasibility Research Summary 3-B. Alternatives - Pest Control Regimen Costs 3-C. Alternatives - Crop/Commodity Yield and Revenue 3-D. Alternatives - Other Operating Costs **Worksheet 4.** Additional Information **Worksheet 5.** Alternatives - Research Plans **Worksheet 6.** Application Summary **Fumigation Cycle** **Climate Zone Map**

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IS MY INFORMATION CONFIDENTIAL?	The applicant may assert a business confidentiality claim covering part or all of the infomration in the application by placing on (or attaching to) the information, at the time it is submitted to EPA, a cover sheet, stamped or typed legend, or other suitable for of notice employing language such as trade secret, proprietary, or company confidential. Alledgedly confidential portions of otherwise non-confidential documents should be clearly identified by the applicant, and may be submitted separately to facilitate identification and handling by EPA. If the applicant desires confidential treatment only until a certain date or until the occurrence of a ceratin event, the notice should so state. Information covered by a claim of confidentiality will be disclosed by EPA only to the extent, and by means of the procedures set forth under 40 CFR Part 2 Subpart B; 41 FR 36902, 43 FR 400000. 50 FR 51661. If no claim of confidentiality accompanies the information when it is received by EPA, it may be made available to the public by EPA without further notice to the applicant.
WHEN IS THE INFORMATION NEEDED?	This application must be postmarked to the EPA address below no later than 120 days after the Notice was published in the Federal Register requesting critical use exemption applications.
WHERE DO I SUBMIT THE APPLICATION?	**Electronic Address for applications:** methyl.bromide@epa.gov **(When submitting an application electronically, you should also print a hard copy, sign the copy, and submit it by mail)**
	Mailing Address for applications being submitted by mail directly to the EPA: US Environmental Protection Agency Methyl Bromide Critical Use Exemption Global Programs Division, Mail Code 6205J 1200 Pennsylvania Ave, NW Washington, DC 20460-0001
	Address for applications being sent by courier or non-U.S. Postal overnight express delivery to EPA: US Environmental Protection Agency Methyl Bromide Critical Use Exemption Global Programs Division 501 3rd St. NW Washington, DC 20001 phone: (202) 564-9410
HOW CAN I RECEIVE ADDITIONAL INFORMATION?	If you have general questions about this application call: Stratospheric Ozone Hotline 1-800-296-1996

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EXCEL USER TIPS

Inserting a blank worksheet:

1. To add additional blank worksheets in the Excel file, go to the menu line at the top of the worksheet and select "Insert" then "worksheet"
2. A tab with the name "Sheet 1" will appear at the bottom of the worksheet and will be highlighted in white. Take the cursor and double click the "new tab"
3. By double clicking in the tab you can now rename the worksheet to the appropriate number letter designation (e.g., 3-A(1), 3-A(1)(a), etc.)
4. To move a newly inserted worksheet, simply drag the worksheet with your mouse to the desired location.
5. Once you add a new worksheet, Excel will automatically name each subsequently added worksheet as Sheet 2, Sheet 3, Sheet 4, etc... Follow the instructions above to rename the new blank worksheets as appropriate.

Copying and pasting an entire worksheet's contents into a blank worksheet:

1. Select the worksheet to be copied by clicking on the worksheet tab at the bottom of the screen. The tab will turn white in color when it has been selected.
2. Select the top left corner of the worksheet (this is the space to the left of the column A and above the row 1. You will know that the entire worksheet has been selected because the row and column marks as well as the worksheet itself will change to a different color.
3. Go to the menu line at the top of the worksheet and select "Edit" then "Copy".
4. Go to the blank worksheet where you want the copied information to be pasted.
5. Again, select the top left corner of the worksheet (left of column A and above row 1) to select the entire worksheet.
6. Go to the menu line at the top of the worksheet and select "Edit" then "Paste"
7. Change the title row of the newly pasted worksheet from the old worksheet number to be consistent with the worksheet tab.

Note: This is the only way you can copy a worksheet and not lose portions of the text instructions.

Viewing worksheets

Worksheets are best viewed in "Page Brake Preview." To select the view of the worksheet, go to the menu bar and select "View" and then "Page Break Preview." Page break preview shows only the printable area of the worksheet, with the blue lines that surround the screen indicating the edges of each page.

To increase or decrease the size of the page that is viewable on the screen, go to the menu bar and select "View" and then "Zoom".

Navigating between worksheets

The set of four arrows on the bottom left of the screen will help you navigate between worksheets. This is necessary to access the remaining worksheet tabs in the workbook that are not viewable. The two arrows with vertical lines to either the left or right will take you to the first worksheet and to the last worksheet respectively in the workbook. The inner two arrows allow you move the worksheet tabs to the right or to the left incrementally.

The two arrows on the bottom right of the screen allow you to move the worksheet that you are viewing to the right or to the left. This is useful if the viewable area of on the screen is smaller than the entire page that is in the worksheet.

Printing worksheets

If you would like to print all worksheets that are contained in this workbook, go to the menu bar at the top of the screen and select "File" and then "Print." Then in the section of the menu that appears called "Print what," select "Entire Workbook."

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Worksheet 1. Contact and Methyl Bromide Request Information

The following information will be used to determine the amount of methyl bromide requested and the contact person for this request. It is important that we know whom to contact in case we need additional information during the review of the application.

1. **Location**
(Enter the state, region, or county. Provide more detail about the location if relevant to the feasibility of alternatives to methyl bromide.)
MID-ATLANTIC / VIRGINIA / ACCOMACK COUNTY

2. **Crop/commodity**
(Include all crops/commodities that benefit from the application of methyl bromide in a fumigation cycle. A fumigation cycle is the period of time between methyl bromide fumigations.)
CORN, SOYBEANS WHEAT HAY TOMATOES

3. **Climate**
(Individual users should enter their climate zone designation by reviewing the U.S. climate zone map. If a consortium is submitting this application, please indicate the estimated percentage of consortium users in each climate zone. This map is located at the end of this workbook or it can be reviewed online at http://www.usna.usda.gov/ Hardzone/ushzmap.html).
ZONE 7A

4. **Soil type** Check the box(es) for the soil types and percent organic matter that apply to your area. If a consortium is submitting this application, please indicate the estimated percentage of consortium users in each soil type.

Soil Type:	Light _____	Medium ✓	Heavy _____
Organic Matter:	0 to 2% _____	2 to 5 % ✓	over 5% _____

5. **Other geographic factors that may affect crop/commodity yield (e.g., water table).**

6. **Consortium name** VIRGINIA TOMATO GROWERS — **Specialty (check one)**
7. **Contact name** GARY W STEWART — agronomic ✓
8. **Address** PO BOX 318 — economic _____
PARKSLEY, VA 23421
9. **Daytime phone** 757 665 5194 — 10. **FAX** 757 665 6425
11. **E-mail** GSTEW2 VIS.NET

List an additional contact person if available. — **Specialty (check one)**
12. **Contact name** W. SCOTT WEATHINGTON — agronomic ✓
13. **Address** AGRI-TECHNOLOGIES INC — economic _____
3164 GOVERNOR MOORE RD CLINTON, NC 28328
14. **Daytime phone** 910 533 3782 — 15. **FAX** _____
16. **E-mail** _____

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17. **How much active ingredient (ai) of methyl bromide are you requesting for 2005?** 1,000,000 **lbs.**
If a consortium is submitting this application, the data for question 17 and 17a. should be the total for the consortium.

In the question below, area is defined as follows for each user: acres for growers, cubic feet for post harvest operations, and square feet for structural applications.

17a. How much area will this be applied to? Please list units. 6000 ACRES units

18. Are you requesting methyl bromide for additional years beyond 2005? Yes ✓ No ____

18a. If yes, please list year and quantity ai of methyl bromide requested in the table below and explain why you need authorization for multiple years.

If a consortium is submitting this application, the data below should be the total for the consortium.

In the table below, **area is defined** as follows for each user: acres for growers, cubic feet for post harvest operations, and square feet for structural applications.

Year	Quantity ai (lb.) of Methyl Bromide	Area to be Treated	Unit of Area Treated
2006	1,000,000	6200	ACRES
2007	1,000,000	6400	ACRES

19. Target Pest(s) or Pest Problem(s):
(Be as specific as possible about the species or classes of pests relevant to the feasibility of alternatives.)

FUSARIUM WILT WEEDS (OVER 40 SPECIES)
BACTERIAL WILT
PYTHIUM
PHYTOPHORA
NEMATODES

20. If applying as a consortium for many users of methyl bromide, please define a *representative user*. Define exactly, issues such as size of the operation (acres treated with methyl bromide for growers, cubic feet for post-harvest operations, and square feet for structural applications), whether the representative user owns or rents the land or operation, intensity of methyl bromide use (treat regularly or only when pest reaches a threshold), pest pressure, etc.

APPROXIMATELY 7000 ACRES

20a. Explain why this user represents the typical user in the consortium.

STANDARDIZED FARMING PRACTICES IN THE AREA HAVE BEEN JOINTLY ADOPTED AGRONOMICALLY AND MECHANICALLY OVER THE PAST 20 YEARS THROUGH PUBLIC AND PRIVATE RESEARCH

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Worksheet 2. Methyl Bromide - Historical Use of Methyl Bromide

Purpose of Data: To establish a baseline estimate of crop/commodity yields, gross revenues, and costs using methyl bromide.

Worksheet	Title	Instructions specific to each worksheet are located at the top of each sheet.
2-A	Methyl Bromide Use for 1997 - 2000	This worksheet provides data in actual usage for 1997-2000.
2-B	Methyl Bromide - Crop/Commodity Yield and Gross Revenue for 1997-2000	This worksheet provides crop/commodity yield and gross revenue for 1997 through 2000.
2-C	Methyl Bromide - Crop/Commodity Yield and Gross Revenue for 2001	This data provides historical information on crop/commodity yield and gross revenue for 2001.
2-D	Methyl Bromide Use and Costs for 2001	This worksheet isolates use and cost data for 2001.
2-E	Methyl Bromide - Other Operating Costs for 2001	This data is needed to estimate a baseline for operating costs in order to estimate the impact on operating profit and short-run economic viability as a result of not using methyl bromide.
2-F	Methyl Bromide - Fixed And Overhead Costs for 2001	This data is needed to estimate a baseline for total costs in order to estimate the impact on profitability and long-run economic viability as a result of not using methyl bromide.

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Worksheet 2-A. Methyl Bromide - Use 1997-2000

If a consortium is submitting this application, all data should reflect the **actual** data for the consortium.

Col A: Formulation of Methyl Bromide	Enter the appropriate data in Col B-M for each formulation, if known, and/or the totals and averages for all formulations. If you enter only the total for all formulations in the last row of the table, please describe in the comments section the formulations typically used, or the approximate proportions of the formulations used.
Col B, E, H, K: Actual Area Treated	Enter the actual area treated. Note: This number should be the **actual** area treated by the individual user or total for the entire consortium, for the year indicated.
Col C, F, L: Actual Total lbs. ai of Methyl Bromide Applied	Enter the actual total pounds active ingredient (ai) of methyl bromide applied. Note: This number should be the total pounds ai applied by the individual user or the entire consortium, for the year indicated.
Col D, G, J, M: Actual Average lbs. ai Applied per Area	The average application rates in pounds ai of methyl bromide per area are automatically calculated from the previous 2 columns.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Formulation of Methyl Bromide	**1997**			**1998**			**1999**			**2000**		
	Total Actual Area Treated	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**	**Total Actual Area Treated**	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**	**Total Actual Area Treated**	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**	**Total Actual Area Treated**	**Actual Total lbs. ai of Methyl Bromide Applied**	**Average lbs. ai Applied per Area**
over 95% methyl bromide												
75% methyl bromide, 25% chloropicrin												
67% methyl bromide, 33% chloropicrin	2835	637875	150	3220	724500	150	3577	804825	150	4247	955575	150
50% methyl bromide, 50% chloropicrin												
__% methyl bromide, __% chloropicrin												
__% methyl bromide, __% chloropicrin												
All formulations of methyl bromide												

Comments:

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Worksheet 2-B. Methyl Bromide - Crop/Commodity Yield and Gross Revenue 1997-2000

If a consortium is submitting this application, the data for this table should reflect the **actual averages** for the consortium.

The purpose of this worksheet is to estimate the gross revenue for 1997 - 2000 when using methyl bromide. Post-harvest and structural users may work with EPA to modify this form to accommodate differences in operations when providing gross revenue data.

Col. A: Year	Be sure to enter the year. Use as many rows as needed for each year for all the crops/commodities in the fumigation cycles from 1997 to 2000. If a fumigation cycle overlaps more than one calendar year, then the year of the fumigation cycle is the year methyl bromide was applied.
Col. B: Crop/Commodity	Enter all crops/commodities that benefit from methyl bromide in each fumigation cycle. (For example, if normally methyl bromide is applied and tomatoes are grown and harvested followed by peppers without an additional treatment of methyl bromide, then both tomatoes and peppers would be part of the same fumigation cycle.) See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for each crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodities produced per area.
Col. E: Price	Enter the average prices received by the users for the year and crop/commodity indicated (1997-2000).
Col. F: Revenue	This number is calculated automatically using the values you entered in Cols. D and E. You may override the formula to enter a different revenue. Please explain why the revenue amount is different in the comment section below.
Total Revenue for 1997-2000	Enter the total revenue per year by adding the revenue for all crops for that year.
Average Revenue per Year:	The average revenue per year is calculated automatically using the summary data you enter for each year.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A Year Methyl Bromide was Applied	B Crop/Commodity	C Unit of Crop/Commodity (e.g., pounds, bushels)	D Crop/Commodity Yield (Units per area)	E Price (per unit of crop/commodity)	F Revenue (per area)
1997	TOMATOES	25LB Box	1763	6.57	11583 $ 0.00
1998	TOMATOES	25LB Box	1900	7.98	15162 $ 0.00
1999	TOMATOES	25LB Box	2010	7.73	19517 $ 0.00
2000	TOMATOES	25LB Box	2120	7.45	15794 $ 0.00
~~2001~~					$ 0.00
~~2~~					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00

Total Revenue for 1997	32837805	$ 0.00
Total Revenue for 1998	48521640	$ 0.00
Total Revenue for 1999	55504309	$ 0.00
Total Revenue for 2000	67077118	$ 0.00
Average Revenue Per Year	51660218	$ 0.00

Comments:

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Worksheet 2-C. Methyl Bromide - Crop/Commodity Yield and Gross Revenue 2001

If a consortium is submitting this application, the data for this table should reflect the **representative user** for the consortium.

The purpose of this worksheet is to estimate the gross revenue for 2001when using methyl bromide. Post-harvest users may modify this form to accommodate differences when providing gross revenue data. If 2001 was not a typical year for the individual or for the representative user of a consortium, the applicant may provide additional data for a different year. However, all applicants must complete this worksheet for the year 2001 regardless. Please explain in the comment section at the bottom of the worksheet why 2001 is not considered a typical year, if that is the case.

Col. A: Crop/Commodity	Enter all crops/commodities that benefit from methyl bromide in the fumigation cycle (interval between fumigations) beginning with the treatment of methyl bromide in 2001. If multiple crops are grown during the interval between fumigations (e.g. tomatoes followed by peppers in a single growing season, or strawberries followed by lettuce over 2 or 3 years) include all of the crops during the entire interval. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If someone other than the applicant benefits from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Price Factors	Enter factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a result of quality, grade, market (e.g. fresh or processing), timing of harvest, etc., you may itemize by using more than one row. Itemize or aggregate these factors to the extent appropriate in making the case that the use of methyl bromide affects these price factors.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for each crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor.
Col. E: Price	Enter average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Revenue	Revenue is automatically calculated using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue amount is different in the comment section below.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A Crop/Commodity	B Price Factors (grade, time, market)	C Unit of Crop/Commodity (e.g., pounds, bushels)	D Crop/Commodity Yield (Units per area)	E Price (per unit of crop/commodity)	F Revenue (per area)
TOMATOES	US #1	25LB Box	2210	6.755	14928$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
				Total Revenue	$ 0.00

Comments:

75,192,360

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Worksheet 2-D. Methyl Bromide - Use and Costs for 2001

If a consortium is submitting this application, the data in Cols. B, C, D, and E should reflect the *representative user* in the consortium. The data in Col. F should reflect the **actual** area treated by all users in the consortium.

If the methyl bromide is custom applied then put the cost per area in Column G and fill in the average lb ai of methyl bromide applied per area (Col B) and the Total Actual Area Treated (Col F).

If 2001 was not a typical year for the individual or for the representative user of a consortium, the applicant may provide additional data for a different year. However, all worksheet why 2001 is not considered a typical year.

Col. A: Formulation of Methyl Bromide	Enter the appropriate data in Col B-G for each formulation, if known, and/or the totals and averages for all formulations of methyl bromide. If you just enter data in the bottom row in the table (All formulations of methyl bromide), please describe in the comments, the relative usage of the various formulations, to the extent known.
Col B: Average lbs. ai of Methyl Bromide Applied per Area	Enter the average pounds active ingredient of methyl bromide applied per area.
Cols. C, D, E, G: Prices and Costs	Enter the average price per pound ai of methyl bromide in Col. C and the average cost of applying methyl bromide per area treated in Col. D. In Col. E, enter the average other costs per area associated with applying methyl bromide (e.g., tarps). Column G will be calculated automatically using the values you entered in columns B-E. If methyl bromide is custom applied, enter the cost per area and fill in Cols. B and F.
Col. F: Actual Area Treated	Enter the **actual** area treated. Note: This number should be the total area treated by all users in the consortium.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G
Formulation of Methyl Bromide	**Lb. ai of Methyl Bromide Applied per Area (2001 Average)**	**Price per lb. ai of Methyl Bromide (2001 Average)**	**Cost of Applying Pesticide per Area (2001 Average)**	**Other MBr Costs (e.g. tarps, etc.) per Area (2001 Average)**	**Total Actual Area Treated in the Consortium**	**Cost per Area**
over 95% methyl bromide						$ 0.00
75% methyl bromide, 25% chloropicrin						$ 0.00
67% methyl bromide, 33% chloropicrin	225	2.50	499.00	200.00	5037	759 $ 0.00
50% methyl bromide, 50% chloropicrin						$ 0.00
__% methyl bromide, __% chloropicrin						$ 0.00
__% methyl bromide, __% chloropicrin						$ 0.00
						$ 0.00
All formulations of methyl bromide						$ 0.00

Comments:

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Worksheet 2-E. Methyl Bromide - *Other* Operating Costs for 2001

Do not include methyl bromide costs.

If a consortium is submitting this application, the data for this table should reflect a **representative user**.

Enter all operating costs except methyl bromide costs incurred during the fumigation cycle (interval between fumigations) beginning in 2001. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. Enter these costs in Col B for custom operations, or in Col C and D for operations done by user.

Submit crop budgets for each crop, if available. You may submit crop budgets electronically or in hard copy. If your costs are significantly different than the crop budgets, please explain in the comments.

Col A: Operation	Identify in Col A the operations (except methyl bromide) to which the costs apply. For growers, these operations should include but are not limited to (1) prepare soil, (2) fertilize, (3) irrigate, (4) plant, (5) harvest, (6) other pest controls, etc. You must include all other operating costs.
Col B: Custom Operation Cost	If you incur custom operation costs, enter those costs in Col. B.
Col C: Material Cost per Area	If you do not incur custom operation costs, enter the material cost per area.
Col D: Labor Cost per Area	If you do not incur custom operation costs, enter the labor cost per area.
Col E: Total Cost per Area	The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col F: Typical Equipment Used	Identify the typical equipment used for operations done by user. Please be specific, such as tractor horsepower. No cost data is required in this column.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Operation	**Custom Operation Cost per Area**	**Operation Done by User**			**Typical Equipment Used**
		Material Cost per Area	**Labor Cost per Area**	**Total Cost per Area**	
Land Preparation		18.00	14.00	32.00 $ 0.00	Tillers, Tractor
Seed		130.50	48.00	178.50 $ 0.00	Seeder
Fertilizer		250.00	5.00	255.00 $ 0.00	Spreader
Chemicals		600.00	110.00	710.00 $ 0.00	Sprayer
Irrigation		78.00	110.00	188.00 $ 0.00	Motors, Filters
Harvest		367	2205.00	2208.67 $ 0.00	Trucks
Grading		0	1090.00	1090.00 $ 0.00	Grading Equip.
Utilities		79.24	0	79.24 $ 0.00	
Containers		1762.00	110.00	1872.00 $ 0.00	Box Machines
Pallets		325.00	0	325.00 $ 0.00	
Twine		10.35	42.00	52.35 $ 0.00	
Stakes		131.91	200.00	331.91 $ 0.00	Air compressor
Miscellany		100.00	50.00	150.00 $ 0.00	
Total Custom per Area	$ 0.00		**User Total per area**	7472.57 $ 0.00	

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Worksheet 2-F. Methyl Bromide Fixed and Overhead Costs

If a consortium is submitting this application, the data for this table should reflect a **representative user.**

Enter **all** fixed and overhead costs incurred during the fumigation cycle (interval between fumigations) beginning in 2001. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle.

Col A: Cost Item	Identify in Col. A the cost items. These items should include, but are not limited to: (1) land rent, (2) interest, (3) depreciation, (4) management, and (5) overhead such as office and administration.)
Col B: Description	Please describe the cost in more detail.
Col C: Allocation Method	Please describe how you estimated the portion of total fixed cost of the farm or entity that applies to this crop/commodity.
Col D: Cost per Area	Enter the cost per area of methyl bromide treated.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D
Cost Item	**Description**	**Allocation Method**	**Cost per Area**
LAND RENT	FARM LAND ON LEASE	100%	150.00
INTEREST	FARM OPERATING LOAN	100%	117.65
DEPRECIATION	BUILDING AND EQUIPMENT	STRAIGHT LINE	88.235
MANAGEMENT		100%	441.18
OFFICE	CLERICAL, SUPPLIES,	100%	135.19
SALES	BROKERAGE	100%	440.53
INSURANCE	FIRE, AUTO MEDICAL, CROP	100%	440.52
REPAIRS-MAINTENANCE	BUILDINGS & EQUIP	100%	293.69
		Total	2901.11 $0.00

Comments:

OMB Control #

Worksheet 3. Alternatives - Feasibility of Alternative Pest Control Regimens

Purpose of Data on Alternative Pest Control Regimens: To estimate the loss as a result of not having methyl bromide available. EPA needs to compare data (yields, crop/commodity prices, gross revenues and costs) on the use of methyl bromide and alternative pest control regimens.

Complete each of the worksheets below (3-A, 3-B, 3-C, and 3-D) for each alternative pest control regimen listed in the "U.S. Matrix" for chemical controls (www.epa.gov/ozone/mbr/cue) and the "International Matrix" for non-chemical pest controls (www.epa.gov/ozone/mbr/cue). Each worksheet contains a place holder in the title for you to insert the name of the specific alternative pest control regimen addressed. You should add additional worksheets as required. Please add a number designation to each worksheet title to indicate a different alternative. For example, for the first alternative pest control regimen label the worksheets as 3-A(1), 3-B(1), 3-C(1), and 3-D(1). For the second alternative pest control regimen label the worksheets 3-A(2), 3-B(2), 3-C(2), and 3-(D)(2).

Enter all alternative pesticides and pest control methods (and associated cost and yield data) that would replace one treatment of methyl bromide throughout the fumigation cycle. See the fumigation cycle worksheet for a comprehensive definition.

Worksheet	Title	
3-A	Alternatives - Technical Feasibility	This form is used to obtain information on the chemical alternatives identified by the Methyl Bromide Technical Options Committee (MBTOC) that are registered for use in the United States, as well as the non-chemical alternatives identified by the MBTOC. Applicants **must** address the technical feasibility of all the chemical and non-chemical alternatives identified on the list.
3-B	Alternatives - Pest Control Regimen Costs	This form is used to estimate the cost of using alternative pest control regimens.
3-C	Alternatives - Crop/ Commodity Yield and Gross Revenue	This form is used to estimate the crop/commodity yields and gross revenues when using alternative pest control regimens.
3-D	Alternatives - Other Operating Costs	This form is used to estimate change in any other costs as a result of using the alternatives.

For EPA Use Only
ID#_____

Worksheet 3-A. Alternatives - Technical Feasibility of Alternatives to Methyl Bromide

In this worksheet, you should address why an alternative pest management strategy on the list (see previous page) is or is not effective for your conditions. This worksheet contains 9 questions. You must complete one copy of worksheet 3-A for each research study you use to evaluate a single methyl bromide alternative. Use additional pages as need.

For worksheet 3-A you must complete one worksheet for each alternative, for each research study addressed. Please number the worksheets as follows. For the same alternative, first research study, label the worksheet 3-A(1)(a). For the same alternative, second research study, label the worksheet 3-A(1)(b). For the first alternative, third research study, label the worksheet 3-A(1)(c). For the second alternative, first research study, label the worksheet 3-(A)(2)(a). For the second alternative, second research study, label the worksheet 3-(A)(2)(b).

When completing Section II, if you cite a study that is on the EPA website, you only need to complete questions 1, 5, and 8.

Summarize each of the research studies you cite in the Research Summary Worksheet.

If you prefer, you may provide the information requested in this worksheet in a narrative review of one or more relevant research reports. The narrative review must reply to Section I and questions 1 through 8 in Section II. A Research Summary Worksheet of relevant treatments should be provided for each study reviewed.

BACKGROUND

EPA must consider whether alternative pest control measures (pesticide and non-pesticidal, and their combination) could be used successfully instead of methyl bromide by crop and circumstance (geographic area.) The Agency has developed a list of possible alternative pest control regimens for various crops, which can be found at http://www.epa.gov/ozone/mbr or by calling 1-800-296-1996.

There are three major ways you can provide the Agency with proof of your investigative work.
(1) Conduct and submit your own research
(2) Cite research that has been conducted by others
(3) Cite research listed on the EPA website

Whether you conduct the research yourself or cite studies developed by others, it is important that the studies be conducted in a scientifically sound manner. The studies should include a description of the experimental methodology used, such as application rates, application intervals, pest pressure, weather conditions, varieties of the crop used, etc. All results should be included, regardless of outcome. **You must submit copies of each study to EPA** unless they are listed on the Agency website.

The Agency has posted many research studies on a variety of crops on its website and knows of more studies currently in progress. EPA will add studies to its website as they become publicly available. You are encouraged to review the EPA website and other websites for studies that pertain to your crop and geographic area.

In addition, EPA acknowledges that, for certain circumstances, some alternatives are not technically feasible and therefore no research has been conducted (i.e. solarization may not be feasible in Seattle). You should look at the list of alternatives provided by the Agency and explain why they cannot be used for your crop and in your geographic area.

Use additional pages as needed.

Alternative: TELONE AND CHLOROPICRIN AND HERBICIDE [Insert Alternative] Study: [Insert Study Title]

Section I. Initial Screening on Technical Feasibility of Alternatives

1. **Are there any location-specific restrictions that inhibit the use of this alternative on your site?**

1a. Full use permitted _____
1b. Township caps ✓
1c. Alternative not acceptable in consuming country _____
1d. Other (Please describe) SOME FIXED BUFFER SETBACKS IN PLACE (300' FROM DWELLINGS, WELLS, AND PONDS)

If use of this alternative is precluded by regulatory restriction for all users covered by this application, the applicant should not complete Section II.

For EPA Use Only
ID#_____

Alternative: [Insert Alternative] Study: [Insert Study Title]

Provide one summary table for each study being described.

Provide a summary table of research information that will allow us compare the impact of methyl bromide and the alternative regimen on such things as pest control, yield or quality of the commodity being treated, or protected. Ideally, a research study should directly compare methyl bromide and the alternative regimen.

Col. A: Treatment Number	List the treatment number from the research study you are citing.
Col. B: Treatment	List what type of pest control method was used.
Col. C: Rate	Enter the pounds or gallons of a chemical used, days of solarization, etc.
Col. D, F, H, J, L, N: Interval	Enter the interval after treatment that the rating was taken. Enter the interval (days, weeks or months) in the column heading or in the comments section. In the comments describe the rating scale (e.g. 0 to 100 where 100 is complete control).
Cols. E, G, I, K, M, O: Rating for Interval:	Use these columns to describe the level of control provided for a specific pest and the time interval at which the rating was taken. For example, a study for nematode control may have looked at nematode and type over "Rating Interval 3" with "6 weeks." If you are completing the printed version, please define Rating Interval in the comments below.
Control of Pests 1 and 2 (Cols. D - I and Cols. J - O):	For the target pest(s) in the study list the pest or pest species being rated in the column header or the comments section. For example, a study for nematode control in tomatoes may have looked at sting nematode and stunt nematode. Enter sting nematode for pest 1 in the Col F header below and stunt nematode for pest 2 in the Col. L header below. In the comments section describe the rating system used (0 to 100 scale where 0 is no control, number of nematodes per gram of soil, number of colony forming units per gram of soil, etc.).
Col. J: Yield	Enter the marketable yield of the crop or commodity and specify the units (lbs./acre, tons) in the column header or comments section.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
Treatment Number	**Treatment**	**Rate (lbs. or gals. ai per area)**	**Pest 1**						**Pest 2**						**Yield (units/area)**
			Interval 1	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating Interval 3**	**Interval 1**	**Rating for Interval 1**	**Interval 2**	**Rating for Interval 2**	**Interval 3**	**Rating Interval 3**	

Comments:

OMB Control #

Section II. Existing Research Studies on Alternatives to Methyl Bromide

1. Is the study on EPA's website? Yes _____ No ✓

   1a. If not on the EPA website, please attach a copy.

2. Author(s) or researcher(s) DR HENRY P. WILSON
   R S BALDWIN
   C.M. WALDENMAIER

3. Publication and Date of Publication TRELLIS TOMATO FUMIGATION TRIAL 1991

4. Location of research study EASTERN SHORE AG EXP. STATION PAINTER VA

5. Name of alternative(s) in study. If more than one alternative, list the ones you wish to discuss.
   VORLEX, TELONE II, TELONE C-17, CHLOROPICRIN

6. Was crop yield measured in the study? Yes _____ No ✓

7. Describe the effectiveness of the alternative in controlling pests in the study.
   NOT AS EFFECTIVE AS methyl BROMIDE

8. Discuss how the results of the study apply to your situation. Would you expect similar results? Are there other factors that would affect your adoption of this tool?
   WE WOULD EXPECT SIMILAR RESULTS

OMB Control #

Trellis Tomato Fumigation Trial - 1991

R. E. Baldwin and C. M. Waldenmaier
Eastern Shore Agricultural Experiment Station

Purpose: To evaluate the efficacy and determine the optimum rate of selected fumigants for the production of trellis tomatoes.

Location: Painter, Va.

Soil Type: Sassafras fine sandy loam. Soil pH: 5.2 before liming on 2/15.

Fertilization: 1 ton/A lime broadcast incorporated on 2/15.
1500 lb/A 10-10-10 banded under beds after subsoiling but before forming beds.

Irrigation: Water was applied daily through high flow drip irrigation tubing. The amount needed was determined by pan evaporation.

Variety: Sunny.

Transplanting Date: Hand planted - 4/29.

Harvest Dates: 7/15, 19, 26, 8/5.

Weed Control: To the alleys - Diquat 1 pt/A + LI 700 1 qt/A applied on 5/10 and 5/22 for control of grasses.
Cultivated alleys with a rototiller on 5/24 then applied.
Dual 8E 2 pt/A + Sencor 75DF 0.5 lb on 5/25.

Insect Control: Asana XL 9.6 oz/A + P.B.O. 16 oz/A + Imidan 50W 2.0lb/A applied 5/1.
Asana XL 6.0 oz/A + P.B.O. 8 oz/A + Thiodan 50W 2.0 lb/A applied on 5/9, 16.
Asana XL 6.0 oz/A + P.B.O. 16 oz/A + Imidan 50W 2.0 lb/A applied on 5/31.

Plot Design: Treatments were applied in a randomized block with four replications. Plots consisted of a single row of tomatoes 35 ft long planted in the center of a plastic covered 3 ft bed and spaced 18 inches apart within the row. Beds were spaced 6 ft apart with trickle tubing installed under the plastic mulch. The plants were staked shortly after transplanting with a 5 ft stake placed between every two plants. The plants were tied three times during the growing season.

Fumigation Date: 4/5/91. Soil temperature 60°F (6" depth).

Application Equipment: The methyl bromide applications were made with a Kennco mulch layer. All other treatments were injected 8 inches deep with a tractor pulled gravity flow applicator fitted with three chisels spaced 12 inches apart. The mulch laying equipment immediately followed the injector, covered the plots with 1.1 ml plastic and installed the trickle tubing. Soil samples from each treatment were collected on 4/15 and 4/26, put in mason jars with lettuce seed, then sealed and checked for germination.

Disease Conditions: Counts of the number of live and dead plants per plot were taken on 5/26 and 6/7. These two counts were almost identical indicating that most plants died within the first three weeks after transplanting. Although plants were too decayed to enable isolation, symptoms resembled Collar Rot caused by Fusarium sp. At harvest the six plants which were picked for yields were cut at the base and weighed. The number of cut stems showing discoloration was recorded and isolations were made from these stems to determine the cause of the discoloration. Fusarium sp. was the only pathogen isolated.

Pre-fumigation soil samples for nematode detection indicated low levels which would not be a factor in plant growth. A soil sample from the non-fumigated check at the end of the season showed that nematode levels had remained low with only 30 stunt (Tylenchorhynchus claytoni) nematodes in 250 cc soil found.

Discussion: Six consecutive plants per plot were picked for harvest. Terrogas 98 had the highest total marketable yield with the Terrogas 80 yielding significantly lower. Increasing rates of Telone C-17 did not appear to increase yield, plant weight or disease control. Although not significant, Vapam had a higher number Large tomato boxes than the Telone treatments.

Trellis Tomato Fumigation Trial - 1991

Fumigant	Rate/A	# 25 lb boxes/ 1000' row					% Culls	%* Dead 5/28	Plant** Weight 8/7	# Stems** Infected 8/7
		Large >2.75"	Small <2.75"	Cull	Total	Total Mkt				
Telone C-17	24 gal	89.8NS	215.0a	35.2NS	340.0ab	304.8ab	10.8NS	0.0b	7.7NS	2.5NS
Telone C-17	30 gal	71.9	194.0ab	34.8	300.7b	266.0b	11.6	9.8ab	7.2	3.0
Telone C-17	35 gal	79.5	224.1a	34.3	337.9ab	303.6ab	10.4	9.8ab	6.9	3.0
Terrogas 98	250 lb	130.1	222.2a	27.8	380.0a	352.3a	7.3	10.8ab	7.1	1.5
Terrogas 80	250 lb	74.1	189.3ab	39.6	302.9b	263.3b	13.3	3.3ab	6.8	2.0
Vapam	50 gal	118.7	180.4ab	29.8	328.8ab	299.0ab	9.1	3.3ab	7.0	1.8
Untreated Check		121.9	163.3b	51.3	336.4ab	285.1b	14.4	14.0a	6.8	1.5

* Percentage of plants per plot dying within three weeks of transplant.

** Plant weights (avg./6) and stem infection taken from the 6 plants per plot picked for yields.

Means within the same columns followed by the same letter do not significantly differ (Duncan's MRT, P = .05).

Effect of Marigold-Tomato Rotation on Yield and Lesion Nematode in Trellis Tomato - 1995

R. E. Baldwin and C. M. Waldenmaier
Eastern Shore Agricultural Research and Extension Center

Purpose: To evaluate the effects on yield and lesion nematode (Pratylenchus penetrans) of planting trellis tomatoes after marigolds and to compare with methyl bromide fumigation.

Location: Painter, Virginia

Soil Type: Bojac sandy loam *Soil pH*: 6.1

Fertilization: 1500 lb/A 10-10-10 applied in the beds on 4/10.

Irrigation: Water was applied in the row through high-flow trickle tubing. Pan evaporation was used to determine the timing and amount of water applied.

Variety: Floradade.

Transplanting Date: 5/8.

Harvest Dates: 7/18, 25, 31, 8/7. Yield taken from six consecutive plants per plot.

Weed Control: Beds were fumigated with 200 lb/A methyl bromide (98%) and covered with plastic on 4/11. Surflan 4S 1 qt/A applied to the alleys 6/9.

Insect Control: Admire 2F 2.5 ml/gal applied with a single nozzle boom on 5/8 before transplant and in the field on 5/23 and 6/2. Admire 2F 3.75 oz/A applied on 6/23. Asana XL 9 oz/A + Agrimec .15EC 16 oz/A applied 6/29, 7/6, 13, 20 for control of corn earworm, beet armyworm, and leaf miner.

Disease Control: Bravo 720 2.0 pt/A applied 6/23, 29, 7/13, 20. Ridomil MZ72 2.5 lb/A applied 7/6.

Plot Design: Treatments were arranged in two 60 ft blocks each subdivided into two replications. Treatments were randomized within each block. Plots consisted of 3 ft plastic mulched beds 30 ft in length spaced 3 ft from adjacent beds. Stakes were placed every two plants and four strings supported the plants between stakes.

Treatment Description:

Rotation: Two 200 ft four row strips of the marigold variety 'Crackerjack' were seeded on 6/7/94; 500 lb/A 10-10-10 and Treflan 3EC 1.0 pt/A were incorporated with a field cultivator just before planting. Preemergence herbicides, Kerb 50W 2.0 lb/A + Lorox DF 0.2 lb/A were applied just after planting. Orthene 75S 1.0 lb/A was applied on 6/17/94 and Asana XL 9 oz/A + P.B.O. 16 oz/A + Imidan 50W 2.0 lb/A + Bravo 720 2.0 pt/A were applied 7/1/94. Marigolds were grown until frost when they were mowed, plowed and pre-formed into beds. Beds were lightly tilled on 4/10/95.

Fumigation: 200 lb/A 98% methyl bromide was applied with a Kennco sled-type bedder/fumigator containing two shanks 18" apart at 30 psi. The beds were sealed with 1.5 ml plastic and high flow trickle tubing was installed during fumigation and bedding on 4/11/95. Soil moisture at the time was 9.4% and soil temperature 60°F.

Discussion: Tomatoes infected with fruit rot (Phoma destructiva) and (Rhizoctonia solani) were graded at harvest. An occasional fruit with anthracnose (Colletotrichum phomides) was encountered and for analysis these numbers were added to the fruit rot values. Culls included misshapen or deformed fruit, fruit with extensive growth cracks or zippers. There were no significant differences in total or marketable yield between treatments. Lesion nematode counts were very low, however, the fumigated treatment significantly reduced lesion nematode numbers when compared with the untreated check.

Effect of Marigold-Tomato Rotation on Yield and Lesion Nematode in Trellis Tomato - 1995

Treatment	Yield (# 25 lb boxes /A)				% Mkt.	% Cull	% Fruit[1] Rot	Lesion #/250 cc 8/15
	Mkt.	Culls	Fruit Rot	Total				
Fumigation	2818.8NS	577.7a	52.4NS	3448.9NS	81.8NS	16.7NS	1.5NS	0.0b
Rotation	2590.5	405.8b	48.4	3044.6	84.6	14.0	1.4	5.0ab
Untreated check	2650.2	437.3b	48.4	3128.6	84.6	14.0	1.4	10.0a

[1]Fruit rot caused by Phoma destructiva, Rhizoctonia solani and small amounts of Colletotrichum phomoides.

Means within each column followed by the same letter are not significantly different (New Duncan's MRT, P = .05).

Control of Root Knot Nematode in Tomato - 1994

R.E. Baldwin and C.M. Waldenmaier
Eastern Shore Agricultural Research and Extension Center, Painter, VA

Purpose: To evaluate the efficacy of the nematicide Fosthiazate 900EC for the control of root knot nematode (Meloidogyne sp.) on ground tomato.

Location: Cedar View, Va. *Soil pH*: 6.1

Fertilization:

1,000 lb/A 10-10-10 applied in a 12-inch band over the marked rows before planting on 5/19.

50 lb/A N (ammonium nitrate) sidedressed on 6/9.

Irrigation: Plots were hand-watered on 6/9.

Variety: Agri-Set.

Transplanting Date: 5/19.

Harvest Dates: 7/27, 8/2, 10, 15.

Weed Control: Treflan 4E 1.0 pt/A + Sencor 75DF .33 lb/A applied just before transplant on 5/19.

Insect Control:

Asana XL 6.0 oz/A + P.B.O. 16 oz/A + Imidan 50W 2.0 lb/A applied on 6/10 and 7/27.

Asana XL 9.0 oz/A + P.B.O. 16 oz/A + Imidan 50W 2.0 lb/A applied on 7/19 for Colorado Potato Beetle and Tomato Hornworm control.

Disease Control: Bravo 720 3.0 pt/A applied 7/19 for control of early blight, soil and fruit rots.

Plot Design: Treatments were arranged in a randomized complete block with five replications. Plots consisted of single 10 ft rows spaced 5 ft apart with a plant spacing of 12 inches and were bordered by untreated guard rows. In an effort to account for the frequently spotty distribution of nematodes throughout a field, an untreated check was planted next to every treated plot in order that the differences between these adjacent plots could be examined.

Application Equipment:

Telone II - Fumigant was injected 6-8 inches deep with a gravity-fed applicator fitted with two chisels spaced 12 inches apart.

Fosthiazate - Nematicide was applied with a propane-pressurized backpack sprayer which applied 30 gal/A at 50 psi. The flat spray boom consisted of 3 TeeJet nozzles spaced 20 inches apart and fitted with 8003 tips. Treatments were incorporated to a 4 inch depth with a rototiller.

Application Dates and Environmental Conditions:

Date	Soil temp.(F)	Soil moisture	Air temp.(F)	Relative Humidity	Wind Speed (mph)
Telone II:					
5/6	62° (6" depth)	8.8%	64°	70%	6-8S
Fosthiazate :					
5/19	60° (4" depth)	7.9%	55°	82%	2-4NE

Nematode Counts: Soil samples were taken just before fumigating on 5/6 (a composite sample of all five replications) and mid-season on 7/6 from each plot. Root infection was evaluated by harvesting 5 plants per plot, washing the roots and assigning a galling index to each root. The galling index system used was Zecks Root Knot Index where the percentage of root galling was separated into 6 classes: 1 = 0, 2 = 1-10%, 3 = 11-30%, 4 = 31-70%, 5 = 71-90%, 6 = 91-100%. The Index was determined by the following formula:

$$\frac{(\#\text{ plants x class 1}) + (\#\text{ plants x class 2}) \text{ etc.} \times 100}{6 \times (\text{total } \#\text{ plants})}$$

Discussion: Yields are expressed as total weight of ripe fruit. Fruit was not graded for size, malformations or disease. Yields in this test do not appear to reflect nematode control. All treatments showed significant control of root infection when compared to the untreated checks. When treatments alone are compared statistically, Fosthiazate 4.8 pt/A had significantly lower root infection than the Fosthiazate 3.2 pt/A. Likewise, the 4.8 pt/A rate had the highest numerical % decrease in soil root knot nematodes and highest numerical % root knot control when galling indices of treated plots are compared with their respective untreated check plots.

Control of Root Knot Nematode in Tomato - 1994

Treatment and Product rate/A	Applic. Method	Root Knot[1] #/250 cc soil 5/6	7/6	% Decrease	Galling[2] Index 9/8	Yield Ton/A
Fosthiazate 900EC 3.2 pt	Broad-cast	85.0	3.7NS	96.1a	35.3b	13.1ab
Check 1		110.0	20.0	81.8b	75.3a	13.2ab
Fosthiazate 900EC 4.8 pt	Broad-cast	115.0	0.0	100.0a	20.7b	11.4b
Check 2		200.0	18.0	91.0ab	65.3a	16.4a
Telone II 18 gallons	Fumigant	205.0	6.0	97.1a	26.0b	14.0ab
Check 3		130.0	12.0	90.8ab	70.0a	14.0ab

[1] Samples taken on 5/6 are a composite of 5 replications and therefore are not statistically analyzed.

[2] Zecks Root Knot Index = 6 galling classes: 1 = no infection, 2 = 1-10%, 3 = 11-30%, 4 = 31-70%, 5 = 71-90%, 6 = 91-100% and the following formula:

$$\frac{(\#\text{ plants x class 1}) + (\#\text{ plants x class 2}) \text{ etc.}}{6 \times (\text{total \# plants})} \times 100$$

Comparison of Treatments

Treatment and Product rate/A	Applic. Method	Galling Index[1]	%Root Knot[2] Control
Fosthiazate 900EC 3.2 pt	Broad-cast	35.3a	53.3NS
Fosthiazate 900EC 4.8 pt	Broad-	20.7b	65.6
Telone II 18 gallons	Fumigant	26.0ab	61.7

[1] Statistical comparison of treatments only.

[2] Decrease in root infection measured by the following formula:

$$\frac{(\text{Galling index of check}) - (\text{Galling index of treatment})}{(\text{Galling index of check})} \times 100$$

Means within each column followed by the same letter are not significantly different (Duncan's Multiple Range Groupings, P= .05).

Control of Lesion Nematode in White Potato - 1992

R. E. Baldwin and C. M. Waldenmaier
Eastern Shore Agricultural Experiment Station

Purpose: To determine the effectiveness of selected nematicides, injected fumigants and crop rotation with four different marigold varieties for the control of lesion nematode (Pratylenchus penetrans).

Location: Painter, Va.

Soil Type: State sandy loam. Soil pH: 6.7

Fertilization: 1,000 lb/A 10-10-10 broadcast incorporated on 3/24.

Variety: Superior.

Planting Date: 3/24.

Harvest Date: 7/10.

Weed Control: Dual 8E 1.5 pt/A + Sencor DF 0.5 lb/A applied at drag-off on 4/16.

Insect Control: Asana XL 9.6 oz/A + P.B.O. 16 oz/A + Imidan 50W 2.0 lb/A applied 4/24.
Bay NTN 33893 240FS 100 ml/A applied 4/30, 5/11, 14, 22.

Plot Design: Treatments were arranged in a randomized complete block with five replications. Plots consisted of three, 35 ft rows spaced 3 ft apart with a plant spacing of 12 inches within the row and were bordered by untreated guard rows. The center row was harvested for yield.

Application Methods:

Nematicide - Both treatments were applied to the uncovered seed in the open furrow. Granular Temik was applied with a hand shaker in a steady stream into the bottom of the furrow. Liquid Furadan was sprayed into the open furrow with a single nozzle boom fitted with a TeeJet 8003 flat fan nozzle.

Fumigation - Fumigants were injected 6-8 inches deep on 11/4/91 with a gravity-fed broadcast applicator fitted with six chisels spaced 12 in. apart for the Telone treatments and 6 in. apart for the Busan treatments. Busan was applied in a 3:1 water solution. The soil surface was sealed with a weighted drag followed by a cultipacker.

Crop Rotation - Potatoes were planted in areas which had grown four different varieties of Marigold from 5/91 - 10/91 followed by a rye cover crop. All other plots had been planted in potatoes the season before followed by a rye cover crop. The 1991 marigold plots were planted on a site which had been planted in potatoes for many consecutive years.

Application Dates and Environmental Conditions:

Fumigation: 11/4/91, Soil temperature = 48 F (6" depth)
Nematicides: 3/24/92, Soil temperature = 51 F (6" depth)
Air temp. = 47 F, Relative Humidity = 52%, Wind = 0-4 mph

Nematode Counts: Nematode population levels were first assessed with soil and root samples taken in 1991 from each plot of the marigold varieties. Counts were as follows:

Variety	Soil lesion #/250 cc soil		Root lesion #/10 g root
	5/16/91	10/1/91	10/1/91
Nemakill	85.0	5.0ab	0.0b
Xanthophyll	20.0	13.0ab	0.0b
Sparky	85.0	2.0b	0.0b
Crackerjack	50.0	17.0a	2.0a

In 1992, before planting potatoes, a pre-plant soil sample was taken on 3/24 which was a composite of all replicates of each treatment. Soil and root samples were taken mid-season from each plot on 6/12 and soil samples were taken from each plot at harvest on 7/7.

Discussion: The Telone treated plots emerged quicker than other plots, however, within a week potatoes in all other treatments had appeared. Potatoes following all varieties of marigold and those treated with Temik yielded higher than potatoes in the fumigated or Furadan treated plots. Marigold treated plots generally had a higher vigor rating showing a slight delay in senescence. Fumigated plots, Temik, and Nemakill reduced lesion nematode counts to the lowest levels.

Control of Lesion Nematode in Potato - 1992

Treatment and Product rate/A	Applic.[1] Method	Stand Count #/plot 4/24	Stand Count #/plot 5/1	Yield (cwt/A) Chef	Large A	Small A	Size B	Total	Vigor[2] Rating 0-5
Nematicides									
Temik 15G 20 lb	In-furrow	36.4de	85.0ab	24.9abc	197.4abc	57.4NS	35.4d	315.2abc	1.2bcd
Furadan 4F 2.0 qt	In-furrow	30.0e	83.0b	12.7cd	163.9bc	59.4	45.3bcd	281.2c	1.0cd
Fumigants									
Busan 50 gallons	Injected	44.2cd	86.6ab	12.9cd	164.3bc	68.2	52.3abc	297.8bc	1.6abc
Busan 75 gallons	Injected	48.2bc	88.0ab	11.7cd	167.5bc	60.1	48.8a-d	288.2c	1.4bcd
Telone II 12 gallons	Injected	57.6ab	90.2a	7.9d	162.6bc	68.4	64.4a	288.3bc	2.2ab
Telone II 18 gallons	Injected	57.2ab	88.4ab	13.0cd	144.2c	66.4	52.7ab	276.3c	1.4bcd
Telone C-17 24 gallons	Injected	63.0a	89.8a	16.2bcd	158.5bc	69.8	53.8ab	298.3bc	1.3bcd
Marigold Varieties									
Nemakill		36.6de	86.0ab	27.4ab	204.8ab	67.1	44.5bcd	343.7ab	2.6a
Xanthophyll		39.0cde	85.4ab	22.8abc	213.4ab	64.3	42.6bcd	343.1ab	2.4a
Sparky		35.8de	85.6ab	35.0a	224.9a	57.1	41.5bcd	358.5a	2.6a
Crackerjack		39.6cde	88.2ab	23.3abc	208.2ab	60.4	36.3cd	328.3abc	1.8abc
Untreated Check		32.6e	76.4c	16.5bcd	175.0abc	57.1	37.8bcd	286.5c	0.5d

[1]Fumigants injected on 11/4/91; Nematicides applied 3/24/92; Marigolds planted 5/91-10/91 followed by rye cover crop.

[2]Vigor rating taken to show delays in plant senescence and based on a scale from 0-5 where 0 = dead plants and 5 = healthy plants.

Means followed by the same letter do not significantly differ (Duncan's MRT, P=.05).

Control of Lesion Nematode in White Potatoes - 1992

Nematode Counts

Treatment and Product rate/A	Applic.[1] Method	Lesion Nematodes[2] #/250 cc soil 3/24	6/12	7/7	Root Lesion #/10 g roots 6/12
Nematicides					
Temik 15G 20 lb	In-furrow	110.0	3.0ab	45.0b	2.0c
Furadan 4F 2.0 qt	In-furrow	75.0	7.0ab	96.0a	43.0b
Fumigants					
Busan 50 gallons	Injected	0.0	0.0b	2.0b	0.0c
Busan 75 gallons	Injected	0.0	0.0b	0.0b	0.0c
Telone II 12 gallons	Injected	0.0	0.0b	1.0b	0.0c
Telone II 18 gallons	Injected	0.0	1.0ab	1.0b	0.0c
Telone C-17 24 gallons	Injected	0.0	0.0b	0.0b	0.0c
Marigold Varieties					
Nemakill		15.0	1.0ab	23.0b	4.0c
Xanthophyll		5.0	5.0ab	21.0b	23.0bc
Sparky		15.0	9.0a	22.0b	13.0c
Crackerjack		10.0	0.0b	25.0b	13.0c
Untreated Check		175.0	9.0a	114.0a	175.0abc

[1]Fumigants injected on 11/4/91; Nematicides applied 3/24/92; Marigolds planted 5/91-10/91 followed by rye cover crop.

[2]Pre-plant soil samples taken 3/24 are from a composite of all five reps. as an indication of initial population levels.

Means followed by the same letter do not differ significantly (Duncan's MRT, P=.05).

Control of Lesion Nematode in White Potato - 1991

R. E. Baldwin and C. M. Waldenmaier
Eastern Shore Agricultural Experiment Station

Purpose: To evaluate the efficacy of granular nematicides, injected fumigants, and marigold crop rotation for the control of lesion nematode (Pratylenchus penetrans).

Location: Painter, VA Soil Type: Bojac sandy loam Soil pH: 6.1

Fertilization: 1,000 lb/A 10-10-10 banded next to the row at planting on 3/28.

Irrigation: 0.5 inch - 5/22, 23, 24, 28 6/13, 17, 19.

Variety: Superior

Planting Date: 3/28

Harvest Date: 7/18

Weed Control: Dual 8E 1.5 pt/A + Sencor DF 0.5 lb/A applied at drag-off on 4/12.
Diquat 1 pt/A + X-77 1 pt/A applied to facilitate harvest on 7/12.

Insect Control: For control of Colorado potato beetle:
Imidan 50W 2.0 lb/A + Asana XL 9.6 oz/A + P.B.O. 16 oz/A - 4/19, 5/14, 6/15.
Thiodan 50W 2.0 lb/A + Asana XL 9.6 oz/A + P.B.O. 16 oz/A - 4/29 and 5/29.

Plot Design: Nematicide treatments were arranged in a randomized complete block with five replications. Crop rotation plots and fumigation plots were taken from strips across the field which were sectioned into 35 ft lengths. Plots consisted of 3 rows 35 ft long spaced 3 ft apart and bordered by untreated rows. The center row was harvested for yield. Potato roots used for lesion nematode extraction were taken from plants in the adjacent rows.

Application Methods: All granular treatments applied at planting on 3/28.

1" band - Treatment hand shaken into the center of the hill after planting. Before treating the top ridge of the hill was flattened by dragging a 12 x 18 inch section of one inch hardware cloth over the row.

5-7" band - Treatment banded with a hand shaker over the seed in the open furrow.

Fert band - Treatment banded just above the fertilizer band next to the seedpiece.

12" band planter incorporated - Treatment banded with a hand shaker over the rows marked for planting before opening the furrows. Treatment incorporated with the planter at planting.

12" band rototilled - Treatment banded with a hand shaker over the rows marked for planting and incorporated with one pass of a rototiller.

Furrow - Treatment applied with a hand shaker over the seed in the bottom of the open furrow.

Fumigation - On 11/21/90 fumigants were injected 6-8 inches deep with a gravity fed broadcast applicator fitted with chisels spaced 6 inches apart for the Busan treatment and 12 inches apart for the Telone treatments. Busan was applied in a 2:1 water solution (total of 150 gal/A). The soil surface was sealed with a weighted drag followed by a cultipacker. Soil temperature at a depth of 4 inches was 52°F.

Marigold-Potato Crop Rotation - Potatoes were planted into a strip of land adjacent to the test which had grown Marigolds from 5/16/90 to 10/11/90 followed by a rye cover crop. All other plots had been planted in potatoes the season before followed by a rye cover crop.

Nematode Counts: The pre-plant soil sample (3/28) was taken from a composite of all five replicates for each treatment. The mid-season soil and root samples (6/19) and the harvest soil sample (7/23) were taken from each plot.

Discussion: Dry weather and high temperatures contributed to overall low yields. The Crop Rotation and Telone II at 12 gal/A were the only treatments that significantly increased Total and Large A yields over that of the untreated check. The fumigated plots yielded significantly higher than those treated with nematicides. Low stand counts and delayed emergence was evident with the use of Mocap applied in a 5-7" band over the seed. The delay in emergence was even more evident with the addition of Thimet. The Mocap applied in a 1" band after planting had the highest Chef, Large A and Total Yields of the nematicide treatments however also had the highest root lesion nematode count of all treatments. The Temik showed the best suppression of lesion nematode of the nematicide treatments. Busan and Telone C-17 gave slightly better nematode control than the Telone II. All treatments with the exception of the Mocap applied in a 1" band significantly reduced lesion nematode levels in the roots.

Control of Lesion Nematode in White Potato - 1991

Treatment and* Active Rate/A	Applic.** Method	Stand Counts #/Center Row 4/26	4/29	5/3	Yield cwt/A Chef	Large A	Small A	Size B	Rot***	Total
Nematicides										
Mocap 10G 3.36 oz/1000'row	1" band	18.4b	28.0a	30.4ab	2.2b	32.3cde	16.9bc	10.6c	16.4b	78.4cde
Mocap 10G 3.36 oz/1000'	5-7" band	8.6c	19.4b	26.2c	0.4b	19.4e	14.6c	12.4bc	15.4b	62.3e
Thimet 20G 3.0 lb	fert band	17.0b	27.2a	29.8ab	2.5b	21.8de	19.5bc	12.4bc	17.7b	73.9de
Mocap 10G 3.36 oz/1000' + Thimet 20G 3.0 lb	5-7" band fert band	7.2c	17.6b	23.2d	0.7b	16.3e	8.5c	6.7c	15.3b	47.4e
Mocap 10G 3.36 oz/1000'	12" band plt incorp	16.4b	26.6a	28.8b	0.0b	19.7e	12.2c	9.4c	19.2b	60.5e
Mocap 10G 3.36 oz/1000'	12" band rototilled	18.8b	28.6a	30.0ab	0.5b	24.9de	14.7c	11.8bc	16.9b	68.7e
Temik 15G 3.0 lb	furrow	20.0ab	27.6a	29.6ab	0.5b	23.2de	9.6c	11.3bc	17.9b	62.6e
Fumigants - product rate/A										
Busan 50 gal	Injected	20.8ab	30.2a	31.8a	4.6b	57.0bc	17.9bc	9.3c	24.8ab	113.5bcd
Telone II 12 gal	Injected	17.0b	28.6a	31.0ab	4.4b	65.0b	28.5b	17.1b	7.8b	122.7b
Telone II 18 gal	Injected	24.6a	29.6a	31.2ab	3.6b	34.8cde	17.5bc	11.1bc	23.6ab	90.7b-e
Telone C-17 24 gal	Injected	20.0ab	28.4a	31.0ab	5.2b	51.4bcd	13.5c	8.5c	40.2a	118.7bc
Marigold-Potato Crop Rotation		24.6a	28.2a	29.4ab	11.9a	133.6a	41.7a	23.7a	7.5b	218.3a
Untreated Check		20.4ab	29.0a	31.2ab	1.6b	32.2cde	17.3bc	10.4c	19.2b	80.6cde

* Nematicides applied on 3/28/91. Fumigants applied on 11/21/90.
** Application Methods explained in text.
*** Rot = Bacterial Soft Rot or Southern Blight (Sclerotium rolfsii).
Means followed by the same letter do not differ significantly (Duncan's MRT, P = .05).

Control of Lesion Nematode in White Potato - 1991

Nematode Counts

Treatment and* Active Rate/A	Applic.** Method	Lesion Nematodes #/250 cc Soil			Root Lesion #/10 gm Roots
		3/28	6/19	7/16	6/19
Nematicides:					
Mocap 10G 3.36 oz/1000' row	1" band	165.0a	96.0ab	154.0ab	3057.0a
Mocap 10G 3.36 oz/1000' row	5-7" band	45.0f	46.0ab	158.0ab	814.6b
Thimet 20G 3.0 lb	fert band	40.0g	28.0b	43.0bc	676.0b
Mocap 10G 3.36 oz/1000'row + Thimet 20G 3.0 lb	5-7" band fert band	60.0d	51.0ab	12.0c	444.0b
Mocap 10G 3.36 oz/1000' row	12" band plt incorp	50.0e	149.0a	106.0abc	837.0b
Mocap 10G 3.36 oz/1000' row	12" band rototilled	85.0b	125.0ab	208.0a	685.6b
Temik 15G 3.0 lb	furrow	50.0e	37.5ab	28.0c	104.8b
Fumigants - product rate/A:					
Busan 50 gal	Injected	0.0j	14.0b	54.0bc	192.0b
Telone II 12 gal	Injected	25.0h	14.0b	93.0bc	574.0b
Telone II 18 gal	Injected	10.0i	12.0b	49.0bc	306.0b
Telone C-17 24 gal	Injected	0.0j	7.0b	33.0c	148.0b
Marigold-Potato Crop rotation		0.0j	17.0b	69.0bc	420.0b
Untreated Check		65.0c	124.0ab	126.0abc	3311.0a

* Nematicides applied on 3/28/91. Fumigants applied on 11/21/90.
** Application Methods explained in text.
Means followed by the same letter do not significantly differ (Duncan's MRT, P = .05).

Control of Nematodes on Cucumbers - 1987

R. E. Baldwin and C. M. Waldenmaier
Eastern Shore Agricultural Experiment Station, Painter

Purpose: To evaluate selected fumigants for the control of root knot (*Meloidogyne hapla*) lesion (*Pratylenchus penetrans*), cyst (*Heterodera glycines*), stunt (*Tylenchorynchus claytoni*), and spiral (*Helicotylenchus sp.*) nematodes.

Locations: Horntown, VA

Soil type: Sandy loam pH: 5.5

Fertilization: 1000 lb/A 10-10-10 broadcast incorporated on 5/14.

Variety: Poinsett 76

Planting date: 5/28/87

Harvested: 7/20, 27, 8/3

Herbicide: Prefar 4E 1 gal/A + Alanap-L 1 gal/A
pre-plant incorporated - 5/28/87
Basagran 1 pt/A + Poast 1 pt/A + Dash 1% applied 7/10/87.

Insecticide: Thiodan 3E 1 qt/A applied 6/4/87.

Plot Design: Randomized complete block with 5 replications. Single, 30 foot rows spaced 5 feet apart bordered by an untreated guard row.

Application Equipment: Fumigants were injected 6-8 inches deep with a gravity fed applicator containing two chisels per row spaced 12 inches apart and sealed with a drag. Soil temperature at a depth of 6" was 65° F. Treatments were applied on 5/14 two weeks before planting. Furadan 15G was shaken over the row with a hand-held shaker in a 12-inch band just before planting on 5/28.

Nematode Counts: Based on composite soil samples taken pre-treatment (5/14), mid-season (7/13), and harvest (8/3). Root samples were taken from each plot on 8/3 enabling statistical analysis of this data. Root knot populations were low in the pre-treatment counts and did not develop as the season progressed for no root knot nematodes were found in later samplings. Lesion nematode distribution was uneven throughout the field.

Phytotoxicity: None observed.

Discussion: All treatments increased yields over that of the check. Ditrapex at the 4.2 gal/A rate showed a substantially higher yield than any other treatment. The spotty distribution of lesion nematode resulted in high variability in lesion nematode counts from root samples and, therefore, no significant differences between treatments.

Root knot root ratings were not taken because the root knot species was northern root knot (*Meloidogyne hapla*) instead of southern root knot (*Meloidogyne incognita*). Northern root knot does not infect cucumber.

Control of Nematodes in Cucumbers - 1987

Treatment and Product Rate/A	Applic. Method	Nematodes/250 cc Soil[1] Lesion 5/14	Lesion 7/13	Lesion 8/3	Spiral 5/14	Spiral 7/13	Spiral 8/3	Root Lesion[2] #/10 gm
VORLEX 7 gal.	Injected	55.0	0.0	0.0	0.0	0.0	0.0	58.00 NS
SN 556 7 gal.	Injected	15.0	0.0	0.0	25.0	0.0	5.0	11.00
DITRAPEX 4.2 gal.	Injected	15.0	5.0	0.0	0.0	0.0	20.0	13.11
DITRAPEX 7 gal.	Injected	5.0	0.0	0.0	0.0	0.0	0.0	8.25
FURADAN 15G 1.5 lb/1000 ft.	12" band	30.0	0.0	0.0	0.0	5.0	0.0	10.71
UNTREATED CHECK		35.0	0.0	5.0	15.0	0.0	10.0	27.94

[1]Composite sample of 5 replications.

[2]Root samples taken from each plot enabling statistical analysis.

Control of Nematodes in Cucumbers - 1987

Treatment and Product Rate/A	Applic. Method	Stand Count 6/15	Yield bu/a	Nematodes/250 cc Soil[1]						
				Cyst Larvae			Stunt			Root Knot
				5/14	7/13	8/3	5/14	7/13	8/3	5/14
VORLEX 7 gal.	Injected	49.6 NS	361.9 ab	10.0	15.0	30.0	45.0	10.0	0.0	20.0
SN 556 7 gal.	Injected	46.0	322.5 ab	5.0	0.0	0.0	10.0	0.0	15.0	25.0
DITRAPEX 4.2 gal.	Injected	55.6	415.5 a	10.0	10.0	0.0	20.0	0.0	0.0	30.0
DITRAPEX 7 gal.	Injected	51.6	388.1 ab	50.0	0.0	5.0	20.0	0.0	0.0	65.0
FURADAN 15G 1.5 lb/1000 ft.	12" band	53.8	311.0 ab	0.0	15.0	0.0	5.0	0.0	0.0	25.0
UNTREATED CHECK		45.2	281.2 b	35.0	10.0	0.0	0.0	0.0	0.0	40.0

[1]Composite sample of 5 replications. No root knot nematodes were found at later samplings.

Nematode Control in Slicing Cucumbers - 1986

R.E. Baldwin and C. M. Waldenmaier
Eastern Shore Agricultural Experiment Station, Painter, VA

Purpose: To evaluate selected fumigants and nematicides for control of root knot (Meloidogyne sp.), lesion (Pratylenchus penetrans), stunt (Tylenchorynchus claytoni), and spiral (Helicotylenchus sp) nematodes.

Location: Craddockville, VA

Soil type: Sandy loam pH: 6.0

Variety: Poinsett 76

Planting Date: 5/16

Harvested: 7/17, 8/11, 8/20

Herbicide: Alanap-L 1 gal/A + Prefar 4E 3 qt/A - 5/16 preplant inc.
Basagran 1 pt - 6/2; .75 pt - 6/9, 7/29
Poast 1 pt + Agridex 2 pt - 7/28

Insecticide: Thiodan 3E 1.0 qt/A - 5/30, 6/10, 6/14

Fungicide: Bravo 500 1 qt/A - 6/14

Plot Design: Randomized complete block with 4 replications. Single 40 ft rows spaced 5 ft apart and bordered by an untreated guard row.

Application Equipment: Fumigants were applied with a gravity fed applicator with two chisels per row spaced 12" apart and sealed with a drag. Fumigants were injected to a depth of 6-8 inches on 4/29. Furadan 15G was shaken over the row preplant in a 12" band with a hand-held shaker. Foliar sprays were applied with a propane pressurized backpack sprayer which delivered 50 gal/A at 40 psi. The spray boom was equipped with 3 TeeJet nozzles spaced 20 inches apart and fitted with D-4 discs and #45 cores.

Nematode Counts: Based on composite soil samples taken pre-treatment (4/29), mid-season (6/20 and 7/22), and harvest (8/27). Root samples were taken on 8/27 from separate plots so data could be statistically analyzed. Lesion, stunt, and spiral nematode distributions were fairly uniform throughout the field. Root knot distribution was very spotty.

Phytotoxicity: None observed

Discussion: Due to variability between plots, yields were nonsignificant; however, all treated plots yielded better than the check. The CQ 661 at the high rate increased yields by more than 100 bu/A. The Vydate 2L, CQ 661, and Vorlex treatments in

general yielded the highest. The CQ 661 at the high rate gave excellent control of all nematodes. The CQ 661 at both rates and SN 556 gave good lesion nematode control. All treatments showed some root knot control; however, populations were too spotty to show conclusive results.

Nematode Control in Slicing Cucumbers - 1986 - Table 1

Treatment and Product Rate/A	Applic. Method[1]	Nematodes/250 cc soil[2] Root knot 4/29	Root knot 6/20	Root knot 7/22	Stunt 4/29	Stunt 6/20	Stunt 7/22	Stunt 8/27
Vorlex 7 gal	injected	0.0	0.0	20.0	400.0	115.0	140.0	35.0
SN 556 7 gal	injected	90.0	0.0	0.0	555.0	100.0	50.0	45.0
SN 556 10 gal.	injected	25.0	5.0	20.0	610.0	115.0	25.0	55.0
CQ 661 7 gal.	injected	20.0	0.0	0.0	365.0	20.0	80.0	60.0
CQ 661 10 gal.	injected	25.0	0.0	0.0	665.0	25.0	30.0	20.0
Furadan 15G 1.5 lb/ 1000 ft row	12" band	60.0	15.0	20.0	285.0	180.0	35.0	20.0
Vydate 2L 2.0 pt	foliar	15.0	0.0	10.0	365.0	245.0	160.0	60.0
Untreated check		10.0	70.0	30.0	430.0	390.0	290.0	185.0

[1] Foliar application dates - 6/10, 7/14.

[2] Soil nematode counts are a composite of 4 replications and are not statistically analyzed.

Nematode Control in Slicing Cucumbers - 1986 - Table 2

Treatment and Product Rate/A	Applic. Method [1]	Nematodes/250 cc soil [2] Lesion 4/29	Lesion 6/20	Lesion 7/22	Lesion 8/27	Lesion #/5 gm roots	Spiral 4/29	Spiral 6/20	Spiral 7/22	Spiral 8/27	Yield Bu/A
Vorlex 7 gal	injected	280.0	10.0	30.0	0.0	38.8 ab	175.0	25.0	40.0	20.0	686.7 NS
SN 556 7 gal	injected	230.0	15.0	10.0	0.0	5.0 b	305.0	15.0	10.0	45.0	634.7
SN 556 10 gal.	injected	205.0	5.0	10.0	0.0	12.5 b	315.0	15.0	10.0	90.0	652.7
CQ 661 7 gal.	injected	175.0	5.0	10.0	60.0	8.8 b	320.0	0.0	0.0	175.0	694.3
CQ 661 10 gal.	injected	280.0	0.0	0.0	0.0	6.3 b	215.0	0.0	0.0	5.0	717.8
Furadan 15G 1.5 lb/ 1000 ft row	12" band	255.0	70.0	20.0	0.0	50.0 ab	105.0	50.0	60.0	65.0	641.7
Vydate 2L 2.0 pt	foliar	245.0	75.0	110.0	5.0	61.3 ab	95.0	50.0	110.0	55.0	715.5
Untreated check		190.0	240.0	140.0	45.0	97.5 a	85.0	80.0	670.0	235.0	616.2

[1] Foliar application dates - 6/10, 7/14.

[2] Soil nematode counts are a composite of 4 replications and are not statistically analyzed. Root nematode counts are from each plot and are statistically analyzed.

Small letters indicate Duncan's Multiple Range Groupings that do not differ at P=.05.

Plant Bed Fumigation - 84/85

R. E. Baldwin and C. M. Waldenmaier

Purpose

To evaluate fumigants applied to tomato seed beds for the control of diseases and weeds.

Location: Painter, VA Soil Type: Sandy Loam pH: 5.1

Treatment Date: 11/1/84 Temperature: 60°F at 6" depth

Planting Date: 3/8/85

Variety Campbell 1327

Fertilization: 250 lb/A of 10-10-10 broadcast and incorporated prior to fumigation.

Foliar 20-20-20 applied to plants on 4/10/85

Irrigation: 1.0" - 4/16/85; 0.5" - 5/1/85

Plot Design

Each fumigant treatment consisted of three 50 ft beds 5 ft wide and covered with 1.5 ml black plastic film. Beds were treated and covered in the fall. On March 8, the plastic was removed, the beds reformed with a bed-maker, and seeded with 4 rows of tomatoes. Clear plastic (4 ml) film was stretched over metal hoops to cover the seed beds.

Application

Fumigants were applied with a gravity feed applicator with 6 chisels speced 12" apart and sealed with a drag. Fumigants were injected to a depth of 6-8 inches. The black plastic seal was applied immediately after injection.

Discussion

Stand counts and weed ratings were taken just before plants were pulled for transplanting. Disease control was measured by the stand counts obtained. All three fumigation treatments improved germination survival which led to better stands. Fungi responsible for damping off of seedlings are usually Pythium, Fusarium, and Rhizoctonia. No seedling damping off was evident after emergence.

Vorlex at 40 gallons gave excellent weed control. SN 556 at 30 and 40 gallons does not appear to be quite as effective as Vorlex for broad spectrum weed control.

Plant Bed Fumigation - 1984/85

Treatment and Rate/A	Stand Count per 5 ft row	Weed Control (% Control)							
		White Clover	Pepper-weed	Wood Sorrel	Corn Camomile	Thistle	Knot-weed	Grasses	Knawel
Vorlex 40 gal	61	99	98	89	99	99	92	97	99
SN 556 30 gal	60	94	94	80	85	94	88	98	96
SN 556 40 gal	55	70	99	90	99	99	80	94	98
Untreated check	39	00	00	00	00	00	00	00	00

White clover - *Trifolium repens*
Pepperweed - *Lepidium virginicum*
Wood sorrel - *Oxalis* sp.
Corn camomile - *Anthemis arvensis*
Thistle - *Cirsium arvense*
Knotweed - *Polygonum aviculare*
Knawel - *Scleranthus annuus*

NEMATODE CONTROL OF TOMATOES - 1984

R. E. Baldwin and C. M. Waldenmaier

The tomato variety 'Campbell 1327' was used in a trial for the control of root-knot (Meloidogyne incognita), lesion (Pratylenchus sp.) and lance (Hoploaimus sp) nematodes. The soil type was a loam with a pH of 5.4 and an organic matter content of 2.2%.

The plots were planted and treatments applied on May 10. Each treatment consisted of a single row 40 feet long with a 5 foot row spacing and plants spaced 22 inches apart in the row. Each treatment was separated from the adjacent treatment by an untreated guard row. Ten plants from each row were harvested on July 30, August 7, 14, and 21.

Standac 2.67F 2.0 pounds 7" band was applied with a propane pressurized back-back sprayer with a single nozzle boom containing a TeeJet 8003 fan tip at 30 gallons of water per acre at 40 psi. The F3843-4EC was applied with a single soil injection shank in the center of each row at planting. Vorlex at 7.0 gallons/A was applied in the same manner on May 3. The transplanted water treatment of Standac 2.67F was calculated on the basis of 4 ounces of water per plant. Ten plants were dug from each replicate on September 14 and scored for root-knot damage. Soil samples were taken preplant (May 20), 42 days after planting (June 21), and after harvest (September 2) for soil nematode populations.

There were no significant differences in yield or in root-knot ratings. Root-knot populations were low in the beginning of the season but the untreated check larval count was moderate by the end of the season. Samples taken from this field in the fall of 1983 had root-knot counts in excess of 500 per pint of soil. Lance nematode populations were moderate by the end of the season. The Vorlex treatment nematode counts remained low throughout the trial.

NEMATODE CONTROL OF TOMATOES - 1984

Treatment and Rate per Acre[1]	Method of Application	Total Yield T/A	Root Ratings[2]	Nematodes/250 cc soil								
				Root Knot Larvae			Lesion			Lance		
				5/10	6/21	9/2	5/10	6/21	9/2	5/10	6/21	9/2
Standac 2.67F 2.0 lb ai	Transplant water	8.9NS	.15NS	65	15	35	265	180	80	200	65	115
Standac 2.67F 2.0 lb ai	7" band-planter incorporated	9.9	.22	0	0	10	90	90	100	165	80	315
Standac 2.67F 3.0 lb ai	7" band-planter incorporated	8.6	.05	0	0	5	35	75	175	100	5	135
F3843-4EC 4.0 lb ai	single shank 8" deep	9.5	.10	0	0	70	160	350	255	325	90	245
F3843-4EC 8.0 lb ai	single shank 8" deep	9.7	.27	0	0	0	95	210	130	260	240	165
F3843-4EC 12.0 lb ai	single shank 8" deep	9.3	.10	0	15	15	54	185	155	205	195	190
F3843-4EC 4.0 lb ai	single shank 12" deep	8.6	.05	5	0	0	130	165	330	20	35	220
F3843-4EC 8.0 lb ai	single shank 12" deep	8.7	.50	0	0	485	50	105	285	95	20	355
F3843-4EC 12.0 lb ai	single shank 12" deep	9.3	.05	0	0	10	80	260	280	115	65	320
Vorlex 7 gal/A	single shank 8" deep	9.0	.32	0	0	35	52	75	110	65	15	40
Untreated check		8.8	.20	0	0	595	55	75	180	100	30	45

[1] Active rate indicated, product rate not indicated.

[2] Ratings based on scale from 0-5 with 0=none; 1=trace; 2=slight; 3=moderate; 4=severe; 5=very severe with 10 plants/plot rated.

CUCUMBER NEMATICIDE TRIALS - 1982

R.E. Baldwin and J.A. Francis
Eastern Shore Branch, Virginia Truck & Ornamentals Research Station, Painter

A cucumber nematicide trial using the variety 'Poinsett' was conducted for control of root knot (Meloidogyne incognita) and lesion (Pratylenchus sp) nematodes. The soil type was a sandy loam with a pH of 5.8-6.2.

Each treatment consisted of a single row 35 ft long with five replications. Each treated row was separated by an untreated guard row. Vapam treatments were applied with a propane pressurized back-pack with a single nozzle boom equipped with a TeeJet 8003 fan tip nozzle. The Vapam was sprayed on the soil surface in a 12 inch band and immediately incorporated with a rototiller to a depth of 3 inches and followed with a light weight roller to seal the soil surface. Granular treatments were applied with a hand shaker and incorporated by the planter. Fumigants were applied with a tractor mounted Carter Steady-Flow applicator and injected into the soil to a depth of 8 inches with 2 chisels spaced 12" apart and sealed with a weighted board drag. All plots were seeded immediately after the treatments were applied on August 18. The soil temperature was 81° F at a four inch depth.

Nematode counts in pre-treatment soil samples indicated a fair number of lesion nematodes present, but a low population of root-knot. The root-knot population did not reach a satisfactory level in this field test, and therefore root-galling indices were not taken. The late planting and early frost damage accounted for the generally low yields due to the reduction of harvests.

While the 3 gallon rate of Vapam did not lower nematode levels as effectively as the 5 and 10 gallon Vapam rates, it did not delay plant emergence as did those treatments. The injected fumigants as a group performed well in reducing nematode levels. However, the Vorlex treatments delayed plant emergence, and the Soilbrome 90 reduced stand counts as well. The Terrocide 5445 had the highest plant population and yield.

The granular nematicides did well in lesion nematode control, except for the low rate of RE 3005.

ID#_____

Worksheet 3-B. Alternatives - Pest Control Regimen Costs for Alternative: [Insert name of alternative]

If a consortium is submitting this application, the data for this table should reflect a **representative user.**

Col. A: Name of Product and Non-chemical Control	Enter all alternatives and non-chemical pest control that would replace one treatment of methyl bromide throughout the fumigation cycle. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle. If multiple crops are grown during the interval between fumigations (e.g. tomatoes followed by peppers in a single growing season, or strawberries followed by lettuce over 2 or 3 years) include all of the pesticides that replace methyl bromide for the entire interval. Do not include pesticides that are used along with methyl bromide--enter only the additional pest control if methyl bromide were not available. If someone other than the applicant previously benefited from the application of methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Target Pests	Be as specific as possible regarding the species or classes of pests controlled by the active ingredient or pesticide product.
Col. C: Active Ingredients	Use one row for each active ingredient (ai). For example, if a product contains 2 ai's use 2 rows for that product. Once all rows are completed for a given product, only Col. B (if applicable), C, and E need to be completed for additional rows applying to the same product.
Col. D: Formulation	Enter the formulation or the % of active ingredient.
Col. E, F, G: Application Rate	As a cross check, EPA is requesting both the amount of active ingredient in Col. E and product applied per area in Col. F. Indicate the unit of the product in Col. G.
Col. H, I, J, M: Prices and Costs	**Use 2001 prices and costs.** If the product is custom applied you may enter the total cost in the last column (Col. M) and override the formula. If a pesticide is applied by the user, enter the price of the product in Col. H and the cost of applying it in Col. I. Enter any other costs associated with **applying** this product in Col. J, specifying what they are in the comments section at the bottom of this sheet. Col. M will be calculated automatically using the data you have entered.
Col. K: Area Treated	Enter the area receiving at least one application of the pesticide.
Col. L: # of Applications per Year	Enter the number of applications in a fumigation cycle comparable to methyl bromide for this alternative pest control regimen. Since this number is an average, it does not need to be a whole number.
Col. M: Cost per Area in 2001 Dollars	Enter the cost per area in 2001 dollars.
Non-chemical Control	Enter data near the bottom of the form. Identify the control in Col. A. Enter the target pests in Col. B. Describe the non-chemical pest control Col. B-L. Enter the costs in Col. M in 2001 dollars.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F	G	H	I	J	K	L	M
Name of Product	**Target Pests**	**Active Ingredients (ai) in Product**	**Formulation of Product**	**Application Rate**			**Price per Unit of the Product**	**Cost of Applying Pesticide per Area**	**Other Costs per Application**	**Area Treated at Least Once**	**# of Applications per Year**	**Cost per Area (2001$)**
				lbs. ai per Area per Application	**Units of product per Area per Application**	**Product Unit (e.g., lbs., gals)**						
(SEE ATTACHMENT)												
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00
												$ 0.00

Non-Chemical Pest Control	**Target Pests**	**Description**	**Cost/area**

Total	$ 0.00

Comments:
If you do not have the quantitative data for additional crops grown on the same land, please indicate so in the comment section.

OMB Control #

Worksheet 3B:

	Product	Pests	Active Ingredient	Formulation	lbs ai a.i. per app	units/app
1.	Ridomil EC	Rhizoctonia Phythium, Phytophora	mefenoxam	2EC	0.125 ~~0.5~~	8 oz./ac.
2.	Quadris	Phythium	azoxystrobin	2.08F	0.128	8 oz./ac.
3.	Tillam	Weeds	pebulate	6EC	1.5	1 qt./ac.
4.	Dual Mag.	Weeds	metolachlor	7.62 EC	1.61	1.5 pt./ac.
5.	Matrix	Weeds	rimsulfuron	25 DG	0.05	2 oz./ac.
6.	Roundup Ultra	Weeds	glyfosate acid	5SL	0.80	1 qt./ac.
7.	Gramoxone Ex	Weeds	paraquat	3SL	0.75	1 qt./ac.
8.	Sencor	Weeds	metribuzin	4L	1.0	1 lb./ac.
9.	Sandea	Weeds	halsulfuron-methyl	75WDG	0.075	1 oz./ac.
10.	Lorsban 4E	Insects	chloropyrifos	4EC	1.0	1 qt./ac.

	$/oz. Price/unit	$/ac. Price/app	$/ac. App. cost/app	% Area treated	# apps./yr.	Cost/area
1.	5.15	41.25	5.00	100	1	46.25
2.	1.92	15.37	5.00	100	1	20.37
3.	0.52	16.67	10.00	100	1	26.67
4.	0.68	16.36	5.00	100	1	21.36
5.	13.81	27.62	5.00	100	1	32.62
6.	0.42	13.27	5.00	100	1	18.27
7.	0.27	8.52	5.00	100	1	13.52
8.	0.62	10.00	5.00	100	2	15.00
9.	30.00	30.00	5.00	100	2	35.00
10.	0.34	10.85	10.00	100	1	20.85
		189.91	60.00			249.91

Plus alt. Fumigant 250.00

$499.91

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Worksheet 3-C. Alternatives - Crop/Commodity Yield and Gross Revenue for Alternative

[Insert name of alternative]

If a consortium is submitting this application, the data for this table should reflect a *representative* user.

The purpose of this worksheet is to identify the gross revenue for units (crop, commodity, structure) when using an alternative compared to gross revenue when using methyl bromide. Post-harvest and structural users may modify this form to accommodate differences in operations when providing gross revenue data.

Col. A: Crop/Commodity	Enter all crops/commodities that can be grown/treated during the same interval of time comprising a methyl bromide fumigation cycle. Please discuss changes in crop cycles resulting from alternative use in the comments. See the Fumigation Cycle Worksheet for a comprehensive definition of the fumigation cycle.
	If someone other than the applicant benefits from the application of alternatives to methyl bromide in the fumigation cycle and you do not have the quantitative data for the crops grown on the same land, please indicate so in the comments section below.
Col. B: Price Factors	Enter in Col. B any factors that determine prices (e.g., grade, time, market). If you received different prices for your crop/commodity as a result of quality, grade, market (e.g., fresh or processing), timing of harvest, etc., you may itemize by using more than one row. Itemize or aggregate these factors to the extent appropriate in making the case that the use of alternatives affects these price factors.
Col. C: Unit of Crop/Commodity	Enter the unit of measurement for your crop/commodity.
Col. D: Crop/Commodity Yield	Enter the number of units of crop/commodity produced per area for that price factor identified.
Col. E: Price	Enter the average 2001 prices received by the users for that crop/commodity and price factor.
Col. F: Gross Revenue	In the electronic version, revenue is automatically calculated below using the data you entered for yield and price. If revenue is not equal to yield times price, you may override the formula and enter a different revenue amount. Please explain why this revenue amount is different in the comment section

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A **Crop/Commodity**	B **Price Factors** (grade, time, market)	C **Unit of Crop/Commodity** (e.g., pounds, bushels)	D **Crop/Commodity Yield** (Units per area)	E **Price** (per unit of crop/commodity)	F **Revenue** (per area)
TOMATOES	U.S #1	25LB Box	1842	6.755	12442.71 $ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
					$ 0.00
				Total Revenue	62673730 $ 0.00

Comments:

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Worksheet 3-D. Alternatives - Changes in Other Costs for Alternative: [Insert name of alternative]

If a consortium is submitting this application, the data for this table should reflect a *representative user*.

Enter data only for costs (other than the cost of alternative pest control) that change as a result of using the alternatives instead of methyl bromide. Enter the whole cost, not just the incremental changes. Enter the cost in Col. B for custom operation costs, **or** in Col. C and D for operations done by user.

Col. A: Operation or Cost Item	Identify the operations or cost items that change as a result of not using methyl bromide.
Col. B: Custom Operation Cost	Enter custom operation costs that change in Col. B.
Col. C, D, E: Costs per Area	Enter in Col. C and D, material and labor costs per area that change for operations done by user. The total cost per area is calculated automatically from the values you enter in Cols. C and D.
Col. F: Typical Equipment Used	Identify changes in the typical equipment used by the user as a result of not using methyl bromide. Please be specific such as tractor horsepower. No cost data are required in this column.

Area is defined below as follows for each user: acres for growers, cubic feet for post-harvest operations, and square feet for structural applications.

A	B	C	D	E	F
Operation or Cost Item	**Custom Operation Cost per Area**	**Operation Done by User**			**Typical Equipment Used**
		Material Cost per Area	**Labor Cost per Area**	**Total Cost per Area**	
FUMIGATION	N/A	101.47	43.00	144.47 $ 0.00	2 APPLICATORS
WEED CONTROL	N/A	86.00	24.00	110.00 $ 0.00	SPRAY APPLICATOR
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
				$ 0.00	
Total Custom per Area	$ 0.00		**User Total per area**	254.47 $ 0.00	

Comments:

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Worksheet 4. Alternatives - Future Research Plans

Please describe future plans to test alternatives to methyl bromide. (All available methyl bromide alternatives from the alternatives list should have been tested or have future tests planned.) There is no need to complete a separate worksheet for future research plans for each alternative - you may use this worksheet to describe all future research plans.

1. Name of study: FUMIGATION ALTERNATIVES

2. Researcher(s): W. SCOTT WORTHINGTON

3. Your test is planned for: VIRGINIA TOMATO GROWERS

4. Location: EASTERN SHORE OF VIRGINIA

5. Name of alternative to be tested:

1. TELONE C35 WITH HERBICIDE
2. TELONE 2 WITH CHLOROPICRIN AND/OR HERBICIDE
3. VAPAM WITH CHLOROPICRIN WITH OR WITHOUT HERBICI

6. Will crop yield be measured in the study? Yes ✓ No _____

7. If additional testing is not planned, please explain why. (For example, the available alternatives have been tested and found unsuitable, an alternative has been identified but is not yet registered for this crop, available alternatives are too expensive for this crop, etc.)

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Worksheet 5. Additional Information

1. How will you minimize your use and/or emissions of methyl bromide?

1a. Check all methods you will use
___ Nothing
✓ Tarpaulin (high density polyethylene)
✓ Virtually impermeable film (VIF)
✓ Cultural practices (please specify) _____

1b. Will you use other pesticides to reduce use of methyl bromide? Yes ✓ No ___

If yes please specify. Herbicides, Insecticides, Fungicides, Nematicides

1c. Other non-chemical methods: (please specify):
Cover crops

2. Do you have access to recycled methyl bromide? Yes ___ No ✓

If yes, how many pounds? _____ lbs.

3. Do you anticipate that you will have any methyl bromide in storage on January 1, 2005? Yes ___ No ✓

If yes, how many pounds? _____ lbs.

4. What is the cumulative amount spent to date by the user or consortium on research to develop alternatives to methyl bromide (beginning in 1992)? $ _____

5. Other investments, if any, made to reduce your reliance on methyl bromide. Describe each investment and its associated cost.

_____

_____

6. Identify what factors would allow you to stop or reduce your use of methyl bromide (e.g. registration of particular pesticide; completion of research plan; capital outlay).
An economically feasible alternative labeled for disease and weed control.

When do you expect these to occur? _____

7. Range of acres farmed by growers included in this application?
(insert number of users in each category)

___ 0-10 acres
___ 10-25 acres
___ 25-50 acres
___ 50-100 acres
___ 100-200 acres
___ 200-400 acres
✓ over 400 acres

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ID# 02-0012

6. Application Summary

This worksheet will be posted on the web to notify the public of requests for critical use exemptions beyond the 2005 phaseout for methyl bromide

1. **Name of Applicant:** Virginia Tomato Growers
2. **Location:** State of Virginia, USA
3. **Crop:** Tomatoes
4. **Pounds of Methyl Bromide Requested** a.i. 2005 _____
5. **Area Treated with Methyl Bromide** 2005 _____ _____ units
6. **If methyl bromide is requested for additional years, reason for request:**

A viable, proven, reliable, and economically feasible alternative is not available or not labeled.

2006 _____ 1,000,000 lbs.
2007 _____ 1,000,000 lbs.

Potential Alternatives	Not Technically Feasible	Not Economically Feasible	Reasons
Methyl Iodide		✓	Too expensive
Steam/Heat	✓	✓	Not practical/Too expesive
Telone		✓	Expensive/Pending approvals
Chloropic		✓	Expensive/Pending approvals
Herbicides	✓		Effectiveness, carryover
Cultivation		✓	Too expensive
Hand Weeding		✓	Too expensive

8. Range of square feet of the area to which applicants included in

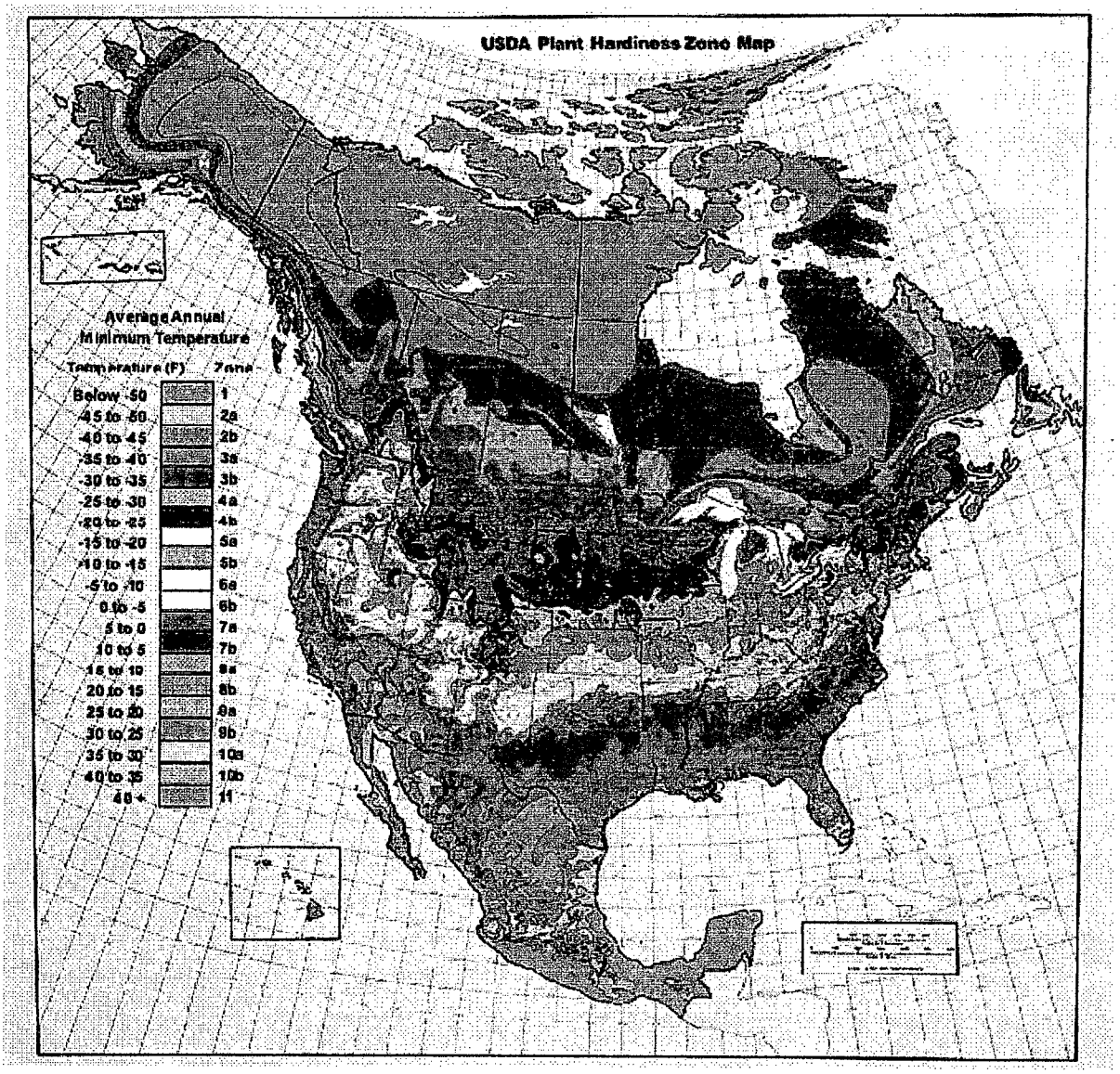
____ 0 - 5,000 sq. ft.
____ 5,001 - 10,000 sq. ft.
____ 10,001 - 20,000 sq. ft.
____ 20,001 - 40,000 sq. ft.
____ 40,001 - 80,000 sq. ft.
____ 80,001 - 160,000 sq. ft.
__✓__ over 160,000 sq. ft.

Information in this application may be **aggregated with information from other applications** and used by the United States government to justify claims in the national nomination package that a particular use of methyl bromide be considered "critical" and authorized for an exemption beyond the 2005 phaseout. **Use of aggregate data will be crucial to making compelling arguments in favor of critical use exemptions.** By signing below, you agree not to assert any claim of confidentiality that would affect the disclosure by EPA of aggregate information based in part on information contained in this application.

I certify that all information contained in this document is factual to the best of my knowledge.

Signature _____ **Date** Sept 6 2002

Print Name Gary W Stewart **Title** Virginia Tomato Grower


USDA Plant Hardiness Zone Map
Average Annual
Minimum Temperature
Temperature (F)
Zone
Below -50
-45 to -50
-40 to -45
-35 to -40
-30 to -35
-25 to -30
-20 to -25
-15 to -20
-10 to -15
-5 to -10
0 to -5
5 to 0
10 to 5
15 to 10
20 to 15
25 to 20
30 to 25
35 to 30
40 to 35
40 +
1
2a
2b
3a
3b
4a
4b
5a
5b
6a
6b
7a
7b
8a
8b
9a
9b
10a
10b
11

7A